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Temperature range in the monkey in ether anæsthesia. (*Preliminary note.*) By Sutherland Simpson.

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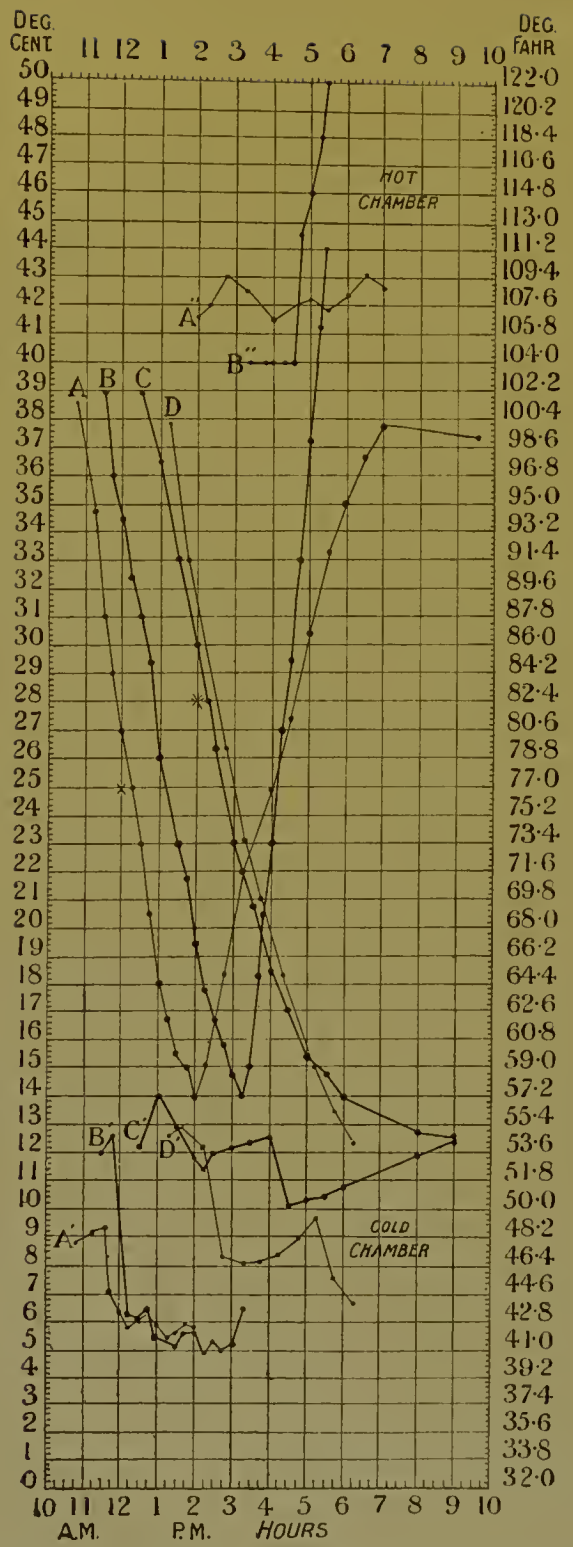
In each of the four experiments recorded here a monkey (*Macacus rhœsus*) was fully etherized, and then placed in a double-walled chamber made of thin tinned sheet-iron, which could be cooled down by placing lumps of ice in the water-jacket, or heated up by pouring in warm water. It was provided in front with a sliding glass door through which the animal could be watched; an opening at the top admitted a thermometer and another opening at the end was connected with a water pump for ventilation, and for the purpose of regulating the ether supply. The bulb of an ordinary short-stemmed centigrade thermometer was introduced well into the rectum, and observations were made every quarter or half-hour on the temperature of the rectum and of the chamber, and on the pulse and respiration rate. Sufficient ether was administered from time to time to keep the animal completely anæsthetised. The temperature curves are shown in the accompanying chart, and the actual readings are given in the tables.

In Experiment I. the animal was placed in the cold chamber at 10.45 a.m. The temperature of the rectum (curve *A*) was then 38·6° C. (101·5° F.) and that of the chamber (curve *A'*) 8·8° C. The rectal temperature rapidly fell until at 2 p.m. it had reached 14° C. (57·2° F.); the respirations were then at the rate of about 2 per minute and the heart-beat had ceased to be palpable at 1·15 p.m., when the temperature had fallen to 16·8° C. At 12.15 p.m. when the rectal thermometer registered 25° C. the ether was stopped, but notwithstanding this the animal continued to sleep on and could not be aroused by pinching the skin or pricking it with a needle, and the temperature continued to fall steadily as before. At 2 p.m. the ice-cold water was poured out and rapidly replaced by hot water, till the temperature of the chamber stood at 41·6° C. (curve *A''*). This involved a delay of only a few minutes not indicated in the chart. The temperature now quickly rose until at 7 p.m. it was 37·7° C., when the animal was removed from the chamber, placed in a warm room (25° C.) and allowed to recover from the anæsthesia. (Etherization was recommenced at 3.15 p.m. when the rectal temperature was 22° C. and before there was any sign of



Curves *A*, *B*, *C*, *D* indicate rectal temperatures, *A'*, *B'*, *C'*, *D'* temperature of eold chamber, and *A''*, *B''* that of hot chamber in corresponding experiments. × Ether stopped. * Animal died.

voluntary movement.) At 9.30 p.m. the monkey was running about the room and quite lively; the rectal temperature was then 37·3° C. It was kept in the laboratory for a month after this experiment and there was no evidence whatever of any bad effects having followed.

EXPERIMENT I. (*Curves A, A', A'' in chart*).

Time	Temp. of chamber	Temp. of rectum	Pulse rate	Respiration rate
10.45 a.m.	8·8° C.	38·6° C.	212	44
11.15	9·2	34·8	196	56
11.30	9·3	31·1	178	42
11.45	7·2	29	154	30
12	6·4	27	114	24
12.15 p.m.	5·8	25*	98	24
12.30	6	23	74	18
12.45	6·2	20·5	76	14
1	5·8	18	48	10
1·15	5·4	16·8	not palpable	8
1.30	5·6	15·5	,,	6
1.45	5·9	15	,,	4
2	5·8	14	,,	2
2·5 p.m.	41·6° C.			
2.15	42	15·2° C.	not palpable	5
2.45	43	18·4	,,	10
3.15	42·5	22†	55	14
4	41·5	24·8	86	15
4.30	42	27·4	112	14
5	42·2	30·4	136	22
5.30	41·8	33·2	148	28
6	42·2	35	154	33
6.30	43	36·5	172	44
7	42·5	37·7	194	58
9.30	25 (room)	37·3		

* Ether stopped.

† Ether re-administered.

Experiment II. gave a curve similar to that of Experiment I., the conditions being practically the same, but in this case the chamber was ultimately heated up to 50° C. Ether was given throughout the whole course of the experiment. The rectal temperature followed that of the chamber until it reached 44° C. (111·2° F.), when the animal died, possibly from an overdose of ether and not necessarily from hyperpyrexia, for at this temperature (50° C.) the percentage of ether vapour in the chamber

EXPERIMENT II. (*Curves B, B', B''*).

Time	Temp. of chamber	Temp. of rectum	Pulse rate	Respiration rate
11.30 a.m.	12° C.	38·9° C.	216	78
11.45	12·5	36		
12	9·5	34·5	206	54
12.15 p.m.	6·3	32·4	184	60
12.30	6·2	31	148	30
12.45	6·4	29·4	130	32
1	5·4	26	124	24
1.30	5·1	23	88	16
1.45	5·6	21·8	64	12
2	5·6	19·5	not palpable	7
2.15	4·9	17·8	,,	5
2.30	5·3	16·8	,,	4
2.45	5	15·9	,,	4
3 p.m.	5·1° C.	14·8° C.	not palpable	2
3.15	6·5	14	,,	1
3.30	40	15	,,	
3.40	40	18·3	,,	6
3.45	40	20·5	72	10
4	40	23	100	15
4.15	40	27	130	36
4.30	40	29·5	180	29
4.45	44·5	33	240	32
5	46	37·2	252	39
5.15	48	41·2	266	56
5.25	50	44	286	64
5·27 animal died				

was very high. In a little over two hours the rectal temperature had risen through 30° C. (54° F.).

In Experiment III. the animal died early, probably from ether poisoning, but the temperature was observed as before and it showed that the dead monkey cooled down at about the same rate as the others.

EXPERIMENT III. (*Curves C, C'*).

Time	Temp. of chamber	Temp. of rectum	Pulse rate	Respiration rate	Time	Temp. of chamber	Temp. of rectum	Pulse rate	Respiration rate
12.30 p.m.	12·2° C.	38·9° C.	186	70	4 p.m.	12·6° C.	18·5° C.		
1	14	36·5	172	82	4.30	10·2	17		
1.30	12·9	33	144	66	5	10·4	15·5		
2	11·8	30	50	38	5.30	10·5	14·8		
2.15	11·5	28*			6	10·8	14		
2.30	12	26·4			8	11·9	12·8		
3	12·2	23			9	12·4	12·6		
3.30	12·4	20·8							

* Animal died.

In Experiment IV. the animal succumbed when its temperature had been reduced to 12·5° C. (54·5° F.).

EXPERIMENT IV. (*Curves D, D'*).

Time	Temp. of chamber	Temp. of rectum	Pulse rate	Respiration rate	Time	Temp. of chamber	Temp. of rectum	Pulse rate	Respiration rate
1.15 p.m.	12·7° C.	37·8° C.	208	48	4.15 p.m.	8·4	18·3	not palpable	9
1.45	12·8	33·1	156	30					
2.15	12·3	29·6	120	28	4.45	9	16·6	,,	6
2.45	8·3	26·4	90	22	5.15	9·7	15	,,	5
3.15	8·1	23·2	62	20	5.45	7·6	13·5	,,	5
3.45	8·2	21	54	18	6.15	6·7	12·5	,,	2
					6.20 animal died				

It is a well-known fact that chloroform, ether, alcohol, morphia and other narcotics have the power of paralysing the heat regulating mechanism, so that a warm-blooded animal can no longer maintain its temperature and becomes for the time being cold-blooded. This is very well seen in these experiments, but in addition they show two other points of interest. (1) It is remarkable that an animal so high in the scale of homoiothermism as the monkey should suffer no bad effects from having its temperature reduced to 14° C. (57·2° F.)—a fall from the normal of about 54° F. (2) When the rectal temperature fell sufficiently low—from 25° C. to 23° C.—a condition of what might be termed artificial hibernation was induced and in this condition the animal remained and tended to take the temperature of the medium in which it was placed. It had no power of self-recovery, and continued to sleep on until warmed by artificial means.